

LEAN CONSTRUCTION PHILOSOPHY DIFUSSION: THE COLOMBIAN CASE

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ABSTRACT

Institutional analysis of organizations have developed a rich framework and empirical insights about how new practices become established via diffusion. Nevertheless, lean construction literature has paid scant attention to organizational practices dissemination and it is important to improve the understanding of how lean construction philosophy diffusion effectively occurs. Drawing on institutional and lean construction literature and interviews with leading construction companies' directors, this study seeks to understand the case of lean construction dissemination over the Colombian construction housing sector. As a result, the study provides an analysis of the relevance and effectiveness of lean construction diffusion strategies, thus helping construction sector leaders to review and improve current approaches.

KEYWORDS

Lean construction, practices, institutions, diffusion, and developing country.

INTRODUCTION

Lean construction (LC) practice is represented as a holistic process with a specific goal on the removal of waste while improving productivity (Koskela, 1992; Botero, 2006). Predominantly this process focused on relationships between the customer and client as well as problems related with labour, finance, delivery, design and flow (Koskela, 1992; Freire & Alarcón, 2000; Alves & Tsao, 2007; Chesworth, London, & Gajendran, 2010). Nowadays, LC theorization has have a shift in focus from resource management towards a more human centered approach (Arbulu & Zabelle, 2006; Chesworth et al., 2010). Nevertheless, as Chesworth et al. (2010) proposed 'this shift in theorization still tends to use outdated interpretation models and methods to understand lean adoption rather than post-modern models'. Furthermore, lean theorization has paid scant attention to organizational practice dissemination. Such approach fails to understand how lean diffusion occurs throughout the implementation of practices. From Chesworth et al. (2010) LC diffusion perspective and supported on institutional organizational analysis approach, this paper proposes a contextualization on the case of lean construction dissemination within a representative set of Colombian building construction companies. The case was

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developed from interviews conducted with managers and entrepreneurs, and with Luis Fernando Botero from Universidad Eafit, the LC principal diffuser in Colombia, which show the current balance of lean diffusion.

THEORETICAL FRAMEWORK

According to the new institutional theory, the diffusion of a practice, such as LC, across space and time has a triple significance (R. Scott, 2008). First, diffusion of a set of practices is often considered as an indicator of the extent that an economic sector is dominated by a particular institutional arrangement. Second, since the diffusing elements are being adopted by organizations, studies of diffusion are properly treated as studies of institutional effects. The adoption of an organizational practice is often argued to follow different principles because of the changing strength of the institutions and also because of the varying characteristics of the adopting organizations. Finally, the spread of a practice is also an instance of institutional change within an organizational field⁴.

Numerous academic interrogations are helpful in understanding the various ways in which practices are diffused. One of the most important has been the DiMaggio and Powell's (1983) question: why there is such startling homogeneity of organizational forms and practices. Accordingly, they proposed an answer to that interrogation from the creation of a useful typology that focuses on three contrasting mechanisms: coercive, mimetic, and normative; all of them highly supported by empirical studies (R. Scott, 2008; W. Scott, 1998). These ones identify varying motives for adopting new organizational behaviours and practices that produce organizational isomorphism⁵ (DiMaggio & Powell, 1983). Thus, coercive mechanisms stems from political influence and the problem of legitimacy⁶; mimetic mechanisms results from standard responses to uncertainty; and normative mechanisms are associated with professionalization⁷ (Boxembau & Jonsson, 2008; DiMaggio & Powell, 1983). The first mechanism on coercive isomorphism results from both formal and informal pressures exerted on organizations by other organizations on which they depend and by cultural expectations functions (DiMaggio & Powell, 1983). In that context, the existence of a common legal environment affects many aspects of the organization's structure and behaviour. Furthermore, organizations tend to model themselves after similar organizations in their sector that they perceive to be more legitimate or successful.

The second source of isomorphism is mimetic and stems from uncertainty that is a powerful force to encourage both organizational and practice imitation (Boxembau &

⁴ Organization field, in the aggregate, constitutes a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products (DiMaggio & Powell, 1983).

⁵ Isomorphism is a constraining process that forces one organization to resemble other organizations that face the same set of environmental conditions (W. Scott, 1998).

⁶ Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions (Suchman, 1995).

⁷ By professionalization, we refer to the collective struggle of members of an occupation to define the conditions and methods of their work, and to establish a cognitive base and legitimation for their occupational autonomy (Larson, 1977).

Jonsson, 2008). Thus, when an organizational practice is poorly understood, when objectives are ambiguous, and when organizational environment produces uncertainty organizations may model themselves after other organizations have done it. Models may be diffused unintentionally and indirectly by organizations such as consulting firms or industry trade associations. Accordingly to Powell and DiMaggio (1983), one of the most dramatic instances of the mimetic mechanism of isomorphism was the effort of Japan's modernizer process in the late XIX century on apparently successful western prototypes. In that case, the imperial government sent its officers to study the courts, army, and police in France, the Navy and postal system in Great Britain, and banking and art education in the United States. In 1980's, American corporations were returning the compliment by implementing Japanese models to cope with productivity and the human resources problem in their own firms.

Normative mechanism, the third source of isomorphism, stems primary from professionalization. In accordance to Powell and DiMaggio (1983), two aspects of professionalization are relevant sources of isomorphism. The first one is the support of formal education and of legitimation in a cognitive base produced by university specialists. The second one is the growth and elaboration of professional networks that span organizations and across which new models diffuse speedily. Universities and both professional and industry association are important places for the development of organizational norms among entrepreneurs, managers, project managers and their organizations (Boxembau & Jonsson, 2008). Normative pressures create a pool of individuals who occupy similar positions across a set of organizations and have similar orientation that may take priority over organizational process variations that might otherwise shape their organizational behaviour (DiMaggio & Powell, 1983; Perrow, 1974). In addition, other mechanism for normative isomorphism is the filtering of personnel. Within many organizational fields filtering occurs through the hiring of professionals from firms within the same industry or from others (Leicht & Fennel, 2008).

The above evidence shows that the isomorphism mechanism encourages homogenization as organizations seek to ensure that they can provide the same benefits and services as their competitors (Boxembau & Jonsson, 2008). Thus, diffusion of a practice is of interest to the more theoretically oriented as it is a tangible indicator of practice implementation and strength maintenance.

Accordingly to Scott (2008), most of the attention to diffusion emphasizes on adoption or demand-side approach. Nevertheless, a supply-side perspective appears well suited to expanding the understanding of the diffusion process. Thereby, our lean construction diffusion case study attempt covers both sides of the institutional approach, as it is shown below.

CASE STUDY PROPOSITIONS

It follows from our explanation of the mechanism by which practice diffusion occurs that we analyse the case of LC diffusion within a set of seven Colombian building construction companies. The propositions are implicitly governed by *ceteris paribus* assumptions; particularly with regard to organization size, technology, economic cycles and exogenous factors abroad the Colombian construction housing sector. These factors were excluded from the analysis since they were not part of the analysis scope, and they had no significant effects on the results (Yin, 2009). Following

Powell and DiMaggio's highly empirical supported isomorphic phenomenon studies, our unit of analysis is both organizational level and organizational field level (Boxembau & Jonsson, 2008).

ORGANIZATIONAL LEVEL PROPOSITIONS

There is variability in the extent at which a construction company (CC) in its field changes to become more like Lean Construction philosophy has recommended. Some CCs respond to LC diffusion quickly; others change only after a long period of resistance. The following two propositions derive from our explanation of coercive isomorphism and constraint.

- **Proposition 1.** The greater the dependence of a CC on another organization, the more similar it will become to that organization in using LC.
- **Proposition 2.** The greater the centralization of CC A's resource supply, the greater the extent to which CC A will change isomorphically to resemble the CC on which it depends for resources.

The mimetic process involved in the search for changing models in organizations is due to the poor understanding of key practices and technology (DiMaggio & Powell, 1983; W. Scott, 1998). Thus, the third and fourth propositions derive from our explanation of mimetic isomorphism, modelling and uncertainty.

- **Proposition 3.** The more uncertain the relationship between means and ends the greater extent to which a CC will model itself after CCs it perceives to be successful in the LC's implementation.

Modeling behaviour is found in situations where the decision of implementing the best practice for project control is repressed in the interest of harmony; thus construction project managers find it easier to mimic other CCs than to make decisions on the basis of systematic analyses of goals since such analyses would prove painful or disruptive in organizational terms (R. Scott, 2008).

- **Proposition 4.** The more ambiguous the goals of a CC, the greater the extent to which the CC will model itself after a CC that it perceives to be successful in the LC's implementation.

The following proposition is supported on the discussion of normative processes. This one is related to the institutional view that the more elaborated the relational networks among organizations and their members, the greater the collective organization of the organizational environment (Meyer & Rowan, 1977; DiMaggio & Powell, 1983; Boxembau & Jonsson, 2008).

- **Proposition 5.** The greater the participation of CC managers in professional associations, the more likely the CC will be, or will become, like other CC in its field.

ORGANIZATIONAL FIELD LEVEL PROPOSITIONS

The sixth proposition is related to the lack of alternative control tools for construction projects. This situation causes homogenization by placing organizations under similar institutional pressure to adopt LC in a context of few alternatives to control projects.

- **Proposition 6.** The fewer the number of visible alternative construction project control in the building housing sector, the faster the rate of LC diffusion in that field.

Finally, the seventh proposition follows from the explanation of professional filtering among CCs (Leicht & Fennel, 2008).

- **Proposition 7.** The greater the extent of professionalization within the construction housing sector the greater the amount of diffusion of LC.

METHODOLOGY

CASE CONTEXT

In Colombia, the implementation of LC philosophy came after its adoption in Chile and Brazil. In the early 2000s, a Colombian construction company brought the notion of LC after a technical mission to Chile, where LC was perceived as an effective management tool to improve the productivity of construction projects. Academics from Universidad EAFIT and Universidad de Los Andes were attracted to LC and joined to its implementation. In those early years, Luis Fernando Alarcón from Universidad Pontificia Católica de Chile gave training courses which encouraged increasingly LC practice. In particular, an academic from EAFIT, Luis Fernando Botero, joined to its adoption decidedly. As a result of this idea, in 2003, Botero developed a project funded by the National Learning Service (SENA), which aimed to perform a quantification of productivity in construction activities of a set of CC in Medellín. Later, in 2005, Botero developed a second project to measure productivity in Bogotá. The Colombian Chamber of Construction (CAMACOL) was interested in these results, thus, they made an agreement with EAFIT's leader to the diffusion of LC. Based on this agreement, in 2006 a significant number of companies agreed to receive LC training and began to implement this philosophy. According to Botero, a total of 35 construction companies were trained on this matter; however, only 18 implemented LC and just half of them have the LC corporate culture and use constantly lean ideals. These companies report that they have implemented LC in their project management processes with diverse results, but overall satisfactory.

DATA COLLECTION AND ANALYSIS

The data for this case was collected and analyzed following the qualitative process case study approach (Yin, 2009). Thus, there were three stages in the methodology. First, documentation concerning the diffusion of LC practices in Colombia was gathered through the analysis of the researches conducted at Universidad de los Andes and EAFIT between the years 2000 and 2012. It was essential to review the available thesis about LC and the papers presented in IGLC from Colombian scholars. Second, semi-structured interviews were done to five entrepreneurs and two top managers of seven construction companies from the cities of Bogota and Medellín

where LC philosophy has been embraced. Those interviews were developed between February and March 2013. Additionally, Luis Fernando Botero was also interviewed in April 2013. The interviews had an average duration of one hour, and all of them were recorded and transcribed for further analysis. According to Yin (2003), a set of questions were prepared before the interviews, and each question was designed to validate individually the seven propositions of this study. The Botero's interview was especially helpful due his remarkable knowledge about the Colombian LC diffusion history. Third, the set of CC's interview transcriptions, the documentation analysis, and the Botero interview were analyzed following a triangulation methodology in order to support the different propositions (Yin, 2009).

RESULTS

Table 1 shows the main results of this study. Proposition 3, 5 and 6 were strongly supported according to the evidence. On the other hand, proposition 1, 2 and 7 were supported. These results are explained in detail as follow.

Table 1: Results about the evidence for each proposition

Propositions	Results about the evidence	
	Strongly supportive	Supportive
P1. The greater the dependence of a CC on another organization, the more similar it will become to that organization in used Lean Construction (LC).		Yes
P2. The greater the centralization of CC A's resource supply, the greater the extent to which CC A will change isomorphically to resemble the CC on which it depends for resources.		Yes
P3. The more uncertain the relationship between means and ends the greater the extent to which a CC will model itself after CCs it perceives to be successful.	Yes	
P4. The more ambiguous the goals of a CC, the greater the extent to which the CC will model itself after CCs that it perceive to be successful.		Yes
P5. The greater the participation of CC managers in professional associations, the more likely the CC will be, or will become, like other CC in its field.	Yes	
P6. The fewer the number of visible alternative construction project control in the building housing sector, the faster the rate of LC diffusion in that field.	Yes	
P7. The greater the extent of professional filtering within the construction housing sector, the greater the amount of diffusion of LC.		Yes

Interviewees agreed that their first approach towards lean construction was due to conferences counting on international experts (i.e. Luis Fernando Alarcón from Chile) promoted by the Colombian Construction Chamber (CAMACOL) and EAFIT University. After these conferences, an alliance between CAMACOL, EAFIT and the specific company was created. Some of the LC ideas were used in pilot projects and CC found that positive changes were taking place. The principal benefit that LC provided was the improvement of productivity (i.e. activity timing and costs were reduced). These improvements were monitored with the use of indicators, and a constant implementation of lean principles in different projects was achieved. In some

cases, there was also continuous support by an expert (e.g. Luis Fernando Botero from Universidad EAFIT) for some period of time. In fact, one of the CC sends its annual report to EAFIT in order to guarantee that they are not modifying or adapting LC principles and that these are properly used. Propositions 1 and 5 are verified as dependence on other organizations is perceptible and the participation of managers in professional associations leads to the adoption of mechanisms that other CCs are using (e.g. the implementation of LC).

LC diffusion within each company leads to the creation of new positions in most cases. These companies require qualified and trained personnel in this matter. The main role of these personnel was to materialize concepts by means of planning, development of reports, personnel involvement and action learning. Two of the interviewees stated that empowering, constant training and motivation of personnel are paramount ways for LC dissemination as workers are key for processes (i.e. downstream workers are the ones who provide results). They also assured that high management understanding and involvement are crucial for LC diffusion. In this case, proposition 7 is noticeable as professionalization is the LC diffusion factor.

CCs have been using certificates in order to guarantee the application of LC in their projects. Interviewees declared that by means of formulating LC as a rule is the only way of adopting this methodology as there are workers that do not use LC. CC main goal is to demonstrate that advantages are not only for the company but for them. In this feature, corporate culture plays a major role. In most cases, workers' knowledge is empirical and there is a constant questioning and aversion for new methodologies. Nevertheless, efforts on training and learning are massive but focused on a small set of tools for project control. In this case, the organizational field depends on those tools. In this sense, proposition 6 is acknowledgeable.

Sharing information among CCs regarding LC seems to be unmanageable in Colombia. CCs know that other companies are satisfactorily implementing LC principles; however, a proper environment should be available to share what they are doing and what is missing. CAMACOL provided spaces for best practices discussion but CCs were not comfortable sharing with others, though interviewees agreed that corporate alliances are opportunities for learning and improving. Knowing that other CCs are having positive results with a particular tool leads to the application of the same method in order to achieve the same or better results. This can be seen as model after a CC practice is perceived to be successful.

Interviewees also recognized that some projects were not suited for LC implementations. In fact, one of them states that LC is inadequate and mistaken for some projects. He argued that every project is different and that trying to apply a uniform procedure is a mistake. He also stated that standardization is inadequate as projects have changing characteristics. However, one interviewee reports that they are trying to standardize all of his projects, mainly in design, in order to reduce time wastes, control activities and avoid abrupt changes, as he claims that the processes of the projects they develop are similar.

CONCLUSIONS

CCs that use LC techniques have been introduced to this philosophy by national entities that develop programs to broadcast their knowledge in this field. However, the adoption of this methodology is demanding and reduced as there are several CCs

that only use a fraction of it (e.g. production control) and workers' culture is a barrier. Moreover, sharing information also represents an obstacle as CCs are protective with their improvements.

Interviews with different CCs entails to organizational isomorphism as the three sources for it to take place are recognized in this study. Coercive isomorphism takes place with trade association with CAMACOL as it involves company structure and behaviour by introducing new methodologies to it. Furthermore, as improvement is perceived, resemblance takes place within different CC. This also leads to mimetism, through the consultant and, in some cases, lacking of full understanding of what the practice really looks for. In fact, poor management and personnel involvement and training, facilitates imitation. Finally, normative isomorphism is crucial for isomorphism. An interviewee affirmed that the only way of employing LC in every project was throughout certification, as this entails that it is mandatory.

This three aspects lead to the delivery of the same services by the CC and mainly to homogenization. Even though, some of the propositions were validated, showing that Colombian CCs are using LC in different extents, homogenization within these companies is not taking place nowadays. It is important to note that normative isomorphism is the most relevant source in the country as filtering and professionalization have wide reception.

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